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FALL-SOWN  
OAT  
PRODUCTION



**F**ALL-SOWN OATS succeed better than spring-sown oats in most sections of the South. From 2,500,000 to 3,000,000 acres are grown annually from fall seeding. Fall-sown oats provide a winter cover for the land, thus preventing erosion. They also furnish winter pasturage and grain and forage for farm animals. The crop may be grown advantageously in rotation with corn and cotton.

The requirements for success with the crop are as follows:

A well-prepared seed bed that is firm beneath with 2 to 3 inches of mellow surface soil. Such a seed bed promotes fall growth and reduces winterkilling to a minimum.

Proper fertilization and rotation with liberal use of legumes and row crops.

Clean seed of adapted varieties treated for smut.

Early seeding with grain drill at rates of 2 to 3 bushels to the acre, assuring sufficient plant and root growth before the advent of severe winter weather.

Harvesting at the proper time to insure maximum yield and quality.

Proper protection of the grain from weather by careful shocking and stacking.

Careful storage of bundled oats as well as of the threshed grain.

The less hardy but well-adapted red-oat varieties, Red Rustproof and Fulghum, and their variously named strains, are recommended for growing in the Gulf States, Georgia, South Carolina, and the eastern portion of North Carolina. The common hardy varieties, such as Winter Turf, Culberson, Tech, and Lee, are recommended for culture in southern Maryland, Virginia, western North Carolina, Kentucky, Tennessee, and Arkansas.

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# FALL-SOWN OAT PRODUCTION

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## IMPORTANCE OF FALL-SOWN OATS

**F**ALL-SOWN OATS succeed better than spring-sown oats in many sections of the South. Except in some of the interior valleys and coastal districts of the Pacific States, oats are grown from fall seeding only in the Southern States.

According to census figures and the annual crop estimates of the Bureau of Agricultural Economics, United States Department of Agriculture, the 16 Southern States, including Delaware, Maryland, West Virginia, Kentucky, Arkansas, Oklahoma, and those southward, grow more than 5,000,000 acres of oats annually, or from 12 to 15 per cent of the total oat acreage of the United States. Of this acreage from 2,500,000 to 3,000,000 acres are grown from fall seeding.

Fluctuations occur annually in the ratio between the harvested fall-sown and spring-sown acreages owing to winterkilling. Fall-sown oats occasionally are injured severely by winterkilling, which in the northern part of the fall-sown area usually results in a temporary decrease in the fall-sown acreage and an immediate increase in the spring-sown acreage. However, with a few favorable years for fall-sown oats the acreage increases rapidly until it is again retarded by abnormally low temperatures.

In many sections of the South oats are exceeded in importance only by cotton and corn. As the development of power farming in the Southern States as yet is not extensive, oats still are in demand as a grain feed for work animals. Oats have a relatively higher cash value per acre in the Southern States than in any other portion of the United States. This results primarily from the greater expense entailed in shipping oats from the main centers of production, owing to the longer haul and greater freight charges.

## THE SOUTHERN FALL-SOWN AREA

Fall-sown oats are not so hardy as winter wheat and rye. They can be grown successfully only when and where the winters are comparatively mild. Consequently, the fall-sown oat area of the South is limited to parts of Delaware, Maryland, Virginia, West Virginia, Kentucky, Tennessee, Arkansas, Oklahoma, and Texas, and to the Carolinas, Georgia, Florida, Alabama, Mississippi, and Louisiana. In the latter group of States fully 60 per cent or more of the oats usually grown are from fall seeding. The development of hardier, more disease-resistant, and more productive varieties should permit further extension of fall-sown oats in these States, as well as in those farther north.

The northern limit of the fall-sown oat area can not be definitely placed, but it is indicated approximately in Figure 1, which shows in a

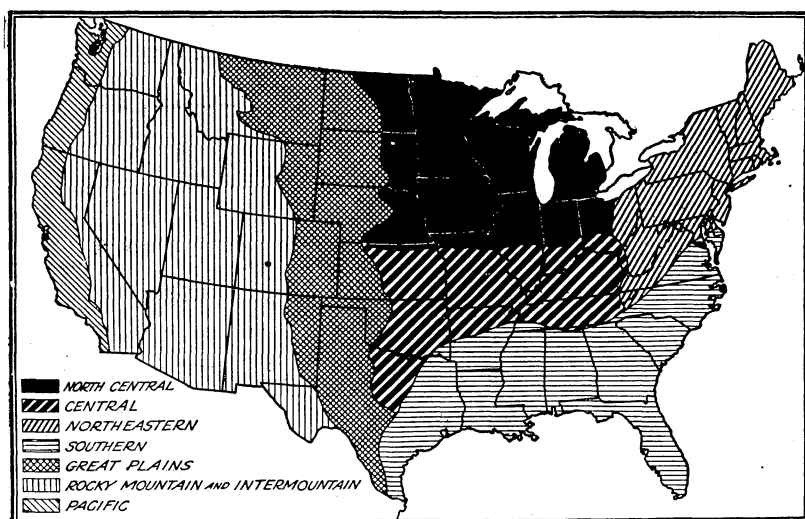


FIGURE 1.—Outline map of the United States, showing the general oat areas. In the southern and Pacific areas the crop is grown from both fall and spring seeding. In all other areas the crop is grown from spring seeding. The central area is often designated as the spring-sown red-oat area. Likewise the southern area is known also as the winter or fall-sown area. (This map is only relative and, therefore, considerable overlapping of areas exists. This is especially true along the boundary between the central and southern areas, owing to the fact that both spring-sown and fall-sown oats may be grown)

general way the oat areas of the United States. Along the northern border of the southern area there are transitional zones in which oats are grown from both fall and spring sowing with about equally good results.

## ADVANTAGES OF FALL SEEDING

A satisfactory crop rotation in the southern United States should occupy the land most of the year. Soil erosion (washing) is a serious problem especially during the winter and early spring in most sections. This is reduced to a considerable extent when the soil is occupied by growing crops. Fall-sown grains have the three-

fold advantage of providing a winter soil covering, a grain crop, and some winter pasturage.

The advantages of fall seeding over spring seeding when fall-sown oats can be grown are many. Usually fall-sown oats produce larger yields and grain of better quality. Also they usually surpass spring-sown oats in yield of forage, a point worthy of consideration in the South, where much of the oat crop is not threshed but is fed in the bundle. Fall-sown oats mature earlier, and the land can be prepared for a succeeding crop to better advantage. Poorer land and less fertilizer also can be used for the fall-sown than for the spring-sown crop.

When fall-sown oats are injured severely by winterkilling the remaining plants stool vigorously. When necessary it is possible to reseed to spring oats without loss of a crop and at a minimum expense for preparing the land.

Fall-sown oats usually grow more vigorously and mature from 10 days to 2 weeks earlier than spring-sown oats. This earlier maturity allows escape from injury by heat, drought, and storms, as well as from rust and other plant diseases, and frequently marks the difference between success or failure.

The oat plant requires comparatively cool temperatures for its best development. Consequently, fall-sown oats, which mature earlier than spring-sown oats, usually are more productive and of better quality because conditions are more favorable for grain development early in the season.

#### SOILS

The area in which oats are fall sown is so large and contains so many widely different soil types that only the most general statements can be made. In most of the coastal plain country the land is rather level and the soil is very sandy. The topography of the Piedmont section varies from slightly rolling to almost mountainous. Heavy clay soils predominate. In the northern part of the fall-sown oat area oats are grown very largely in the mountain valleys. In these areas the soils vary from sandy loams to stiff clays.

Oats are not especially selective as to the soils upon which they may be grown with success. Almost any reasonably fertile soil in the winter-oat belt which retains moisture fairly well is suited to growing the crop. Oats require more water than do other small grains to produce the same quantity of dry matter; for this reason they suffer more quickly from drought. Any soil that will grow a good crop of cotton or corn will produce oats, although the heavier loams will give the best results, provided they are well drained.

The two chief causes of winter injury to oats are heaving and consequent root exposure, and a prolonged period of low temperatures in the absence of a snow covering. Alternate freezing and thawing of the soil in late winter and early spring is especially destructive. This occurs more frequently on clay soils, particularly those containing little humus or partly decayed organic matter. Heaving occurs less on sandy loam soils than on clay soils, especially if the former contain sufficient humus to insure a high moisture-holding capacity. To prevent winterkilling a soil must be well drained. The likelihood from winterkilling is greatest on low,

poorly drained soil. Rust and other diseases also are more likely to damage the crop when it is grown on naturally low, wet soil. Owing to less productive soils, most of the oats grown in the southern part of the fall-sown oat area do not grow so tall and vigorous as those grown in the sections farther north. Hence the danger of oats lodging is not so great. In the more northern parts of the fall-sown oat area taller varieties such as Winter Turf and Culberson are grown. Here the danger from lodging is greater.

#### FERTILIZERS AND MANURES

The soils of the fall-sown oat area differ so widely in topography, texture, and fertility that only general statements can be made regarding the best method of maintaining fertility. Local practice, as a rule, is the best general guide. The fertility of the soil usually is improved in one of the following ways: (1) By the application of barnyard manure; (2) by growing leguminous crops and turning them under as green manure; and (3) by the application of commercial fertilizers.

Usually barnyard manure is not available in the South in sufficient quantities to be much of a factor in soil fertility, because of the small number of livestock in this region. Dependence for maintaining soil fertility must be placed on green-manure crops and commercial fertilizers. Usually it is not advisable to apply barnyard manure directly to oats except on very poor soils. Ordinarily more satisfactory results are obtained by applying it to the previous row crop in the rotation, such as cotton or corn.

The crops most commonly used for green manures in the South are the legumes, such as cowpeas, crimson clover, vetch, velvetbeans, bur clover, peanuts, Austrian winter peas, soybeans, and red clover. Cowpeas, soybeans, and velvetbeans are the most satisfactory crops immediately to precede oats. These crops may be cut for hay, turning under only the stubble and roots, or the entire crop may be used as a green manure.

Some farmers prefer to obtain a return from the crop as pasture before turning it under. This is good practice if the soil is not allowed to become packed by tramping when wet. The fertilizing effect on the following crop is about the same whether the stubble or the entire plant is turned under, but turned-under vines add considerable humus, improving the physical condition of the soil.

If the vines are turned under, the land should be plowed if possible three or four weeks before the oats are sown, as the vines should have time to become partly decayed and the ground to become somewhat settled before seeding. If the oats must be sown as soon as the land is prepared, it is better to harvest the vines and disk the land thoroughly instead of plowing it.

The soils of the fall-sown oat area often are deficient in nitrogen, phosphorus, and potash. If the soil is acid, liming is necessary. These soils also vary widely in fertility, and the costs of fertilizers are subject to market trends. For these reasons only general statements are possible regarding the kinds and quantities of commercial fertilizer to be used.

If the soil has been liberally fertilized for other crops, phosphorus and potash need not be added for oats. Usually, however, increased

yields result from light applications of superphosphate (acid phosphate) and muriate of potash at seeding time. The proper quantity of superphosphate to apply varies. Fertile clay soils do not need so much as do the poorer sandy soils. Usually on fairly fertile soils an application of 100 to 150 pounds of superphosphate per acre will give good results. On the poorer soils from 200 to 250 pounds may sometimes be applied with profit. The rate of applying muriate of potash varies from 30 to 50 pounds on the better clay soils, and from 60 to 100 pounds on poor sandy ones. The price of the fertilizer must be considered. If the price is too high, its use may not be justified by the value of the increase in the oat crop that may be expected.

Nitrogen sometimes is the limiting element in crop production in fall-sown oat areas. If nitrogen has been supplied in liberal quantities by the application of barnyard manure, or as the result of growing legumes as green manures, there should be no need to add it in commercial fertilizers. If the green-manure crop does not immediately precede the oats, or if only a light preceding crop was harvested from the soil, some readily available nitrogenous fertilizer (ammonia) should be used. On most soil types best results are obtained by applying a top dressing of nitrate of soda or ammonium sulphate in the spring at about the time active growth starts. For sandy soils, an application of about 100 to 125 pounds of nitrate of soda to the acre may be profitable. The application may be reduced on clay soils to about 75 to 100 pounds. If the oats are to be used for hay more nitrogen should be added than where a grain crop is desired. Heavy applications of nitrogen stimulate plant growth and produce a heavy yield of straw. Nitrogen also may be applied in the form of cottonseed meal or dried blood. However, for spring top-dressing, quick-acting forms are preferable.

Results of recent fertilizer experiments in the South, particularly in Georgia, favor the use of phosphorus and nitrogen rather than phosphorus alone for fall-sown oats. As a consequence, the practice of applying superphosphate at time of seeding, and nitrate of soda to the growing crop in the spring, is to be recommended.

#### ROTATIONS

The best place in the rotation for oats is after a row crop such as corn or cotton. Usually corn is removed from the soil earlier than cotton, and generally oats should be sown after corn. Probably as good a rotation as has been devised for that part of the fall-sown oat area in which cotton is grown is the following:

First year, cotton with crimson clover, vetch, or Austrian peas, sown as a winter-cover crop.

Second year, corn following plowing under of the winter legume. Cowpeas or soybeans may be sown in the corn at the last cultivation, the corn to be cut as fodder and the cowpeas or soybeans and corn stubble turned under in time to seed fall oats.

Third year, fall-sown oats, followed by cowpeas or soybeans sown as a hay crop, the cowpea or soybean stubble turned under and the soil sown to rye as a winter covering, which is turned under in the spring as a green manure for cotton.

This rotation in three years gives two grain crops, corn and oats; a money crop, cotton; a hay crop, cowpeas or soybeans; and three

green-manure crops, crimson clover, cowpeas or soybeans planted in the corn, and rye. If desired, rye may afford some winter and spring pasturage before it is plowed under for cotton. By growing two crops of cotton the foregoing may be modified into a 4-year rotation. One advantage of this system is that the soil is not allowed to remain over winter without covering. Because of uncertainty in results with crimson clover, vetch or Austrian peas (the latter a comparatively new and promising winter legume) are more satisfactory for winter-cover crops.

Outside the cotton-growing section of the South a satisfactory rotation, including fall-sown oats, is as follows:

First year, corn, with cowpeas or soybeans sown at the last cultivation, the cowpeas or soybeans and corn stubble plowed under in time for fall-sown oats.

Second year, fall-sown oats with clover or grass seeded in the oats.

Third year, meadow or pasture.

If wheat is to be grown in the rotation, where clover is not adapted, and where pasture or meadow is not desired, the following rotation may be used:

First year, corn, with cowpeas or soybeans sown in the corn at the last cultivation, the land plowed in the fall and sown to wheat.

Second year, wheat, followed by cowpeas or soybeans to be cut for hay and the soil plowed in the fall for oats.

Third year, fall-sown oats, followed by cowpeas, soybeans, sorghum, or some other crop suitable for forage. Rye or crimson clover may be sown as a winter covering after the forage crop is harvested, to be plowed under in the spring for corn.

In this 3-year rotation two feed grain crops, corn and oats, are produced; one cash crop, wheat; two green-manure crops, cowpeas, or soybeans in corn, and rye or crimson clover in the wheat stubble; and two forage or hay crops, cowpeas or soybeans following oats, and cowpeas, soybeans, or sorghum following wheat.

Other satisfactory rotations similar to those named may be arranged according to the crops desired. In planning a rotation for the fall-sown oat area ample provision for green-manure crops and winter protection of the soil should not be overlooked.

#### PREPARING THE SEED BED

The method of preparing land for oats depends on the previous crop and on the character of the soil. The success of the crop depends largely on the condition of the seed bed and on the growth of the oats in the fall. The seed bed should consist of 2 or 3 inches of loose, mellow surface soil with a firm layer beneath. Fall-sown oats must be sown on a firm seed bed to insure the maximum protection from winterkilling.

Ordinarily when oats follow corn or other cultivated row crop in the rotation, a very satisfactory seed bed can be prepared quickly and with the minimum of expense. These crops leave the soil in comparatively good condition for oats. Furthermore, as a rule, they can be removed from the ground early enough to permit reasonably early seeding of oats, which is always an important consideration.

On land well plowed for the preceding row crop disking usually is preferable to plowing for fall-sown oats, particularly if the preceding crop has been kept reasonably free from weeds. Plowing does not always insure a firm seed bed, which is so essential for

success with the crop. The cost of seed-bed preparation by disking also is less. Disks should be sharp in order to cut successfully the corn stubble and any other plant residue left on the surface. Disking once with a tandem disk, or two diskings with a single disk, lapping half, and a harrowing usually are sufficient, though on hard, dry soils more work may be necessary.

Plowing usually is inadvisable for oats from the standpoint of cost alone. If plowing is necessary the land should be plowed to a depth of 5 to 6 inches and if possible at least a month before the oats are to be sown. The plow should be followed immediately by a spike-tooth or other smoothing harrow to work down the seed bed and thus make it more retentive of moisture. Double-disking and another harrowing should settle the soil sufficiently to put it in shape



FIGURE 2.—Disking and harrowing plowed land at a single operation for fall-sown oats in the northern part of the fall-sown area

for drilling the oats. If plowing has been delayed until just before time to seed, the roller or a plank drag may be used to make a more compact seed bed. Rolling often may be done advantageously on loose, sandy land, but on the heavier loam and clay soils the roller should be followed with the spike-tooth harrow, to break the crust and check evaporation. Commercial fertilizer should be distributed when the oats are drilled. If the seed is sown broadcast the fertilizer should be applied before the last harrowing. Disking and harrowing the soil at a single operation is shown in Figure 2. Figure 3 shows land being worked with a cultipacker preparatory to fall seeding.

#### PREPARING THE SEED FOR SOWING

The yield and quality of fall-sown oats may be increased considerably by proper care in preparing the seed before planting. Oats used for seed often contain large quantities of foreign matter,

weed seed, etc., which should be removed. The smuts of oats also may be controlled rather easily by seed treatment. The prevalence of smut in the red-oat varieties of the South has increased markedly in recent years, and the desirability of treating fall-sown oats has become more important than formerly.

#### CLEANING AND GRADING

Seed oats should be thoroughly cleaned before sowing. Fanning the seed not only removes the weak, light kernels which are not likely to grow if sown, but also removes many weed seeds. The lighter kernels may be fed to livestock, only the heavier kernels being used for seed. Most weed seeds, such as cheat (chess), a serious pest in fall-sown oat fields, can be removed by thoroughly cleaning the seed.



FIGURE 3.—Land being firmed with a cultipacker in preparation for fall-sown oats

As a rule, seed oats are cleaned with the fanning mill, but when such a machine is not available and the quantity of oats to be screened is not large, fairly efficient work may be done by pouring the oats back and forth from one container to another in a brisk wind. The lighter material will be carried away by the wind. If a considerable quantity of seed is to be sown the gain by sowing clean seed will repay the expense of buying a fanning mill or other cleaning machine.

#### TREATING FOR SMUT<sup>1</sup>

At present several methods of controlling the smuts (fig. 4) of oats with formaldehyde are in use. The treatment may be applied by spraying, sprinkling, or dipping the seed. In all methods 1 pint of commercial formaldehyde (formalin) is used to each 50 bushels of

<sup>1</sup> Prepared under the direction of V. F. Tapke, Pathologist, Office of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.

oats. If fewer bushels of seed are to be treated a correspondingly smaller quantity of solution will be needed. The methods differ only in the quantity of water used and the manner of applying the solution. Regardless of the method used the seed should be thoroughly fanned and screened prior to treating it.



FIGURE 4.—Normal and smutted panicles of oats. Loose smut at left, covered smut at right

Directions for spray method.—Add 1 pint of formaldehyde to 1 pint of water. This is sufficient for 50 bushels. Put the quart of solution in a hand sprayer (not a sprinkling can) and spray the oats while they are being shoveled from one pile to another. Cover the treated pile with clean sacks or covers for at least five hours, or overnight. Then sow immediately or spread out to dry.

Directions for sprinkle method.—Add 1 pint of formaldehyde to 40 gallons of water. This is sufficient to treat 50 bushels. Spread the grain to be treated

in a layer on a clean floor or canvas. Apply the formaldehyde solution from a sprinkling can while the seed is being shoveled from one pile to another. After treatment shovel the grain into a pile and cover with clean sacks or canvas for at least five hours, or overnight. Then sow immediately or spread out to dry.

Directions for dip method.—Add 1 pint of formaldehyde to 40 gallons of water. This is sufficient to treat 50 bushels. Put the seed in loosely woven burlap or gunny sacks. These should be only half filled and tied at the top. Successively dip the grain in this solution and drain until the seed is thoroughly wet. Remove the sacks from the solution and let them stand at least two hours, or overnight. Then sow immediately or spread out to dry.

Care should be taken not to put the treated seed oats into untreated bins, sacks, or machinery where it is likely to come in contact with smut spores.

Surplus treated grain may be fed to farm stock without injury, provided it is thoroughly dry and has been exposed to the air for a few days.

For more detailed directions for treating oat seed for smut the reader is referred to Miscellaneous Publication 21, Formaldehyde Seed Treatment for Oat Smuts, of the United States Department of Agriculture.

In the last few years a number of chemical dusts for the control of oat smuts have come into use and have shown promising results. It is possible that the advent of these new dusts may lead to a more widespread treatment of seed oats for smut control.

#### SOWING THE SEED

Oats are sown in the fall-sown oat area by one of three methods: (1) Broadcast seeding; (2) drilling with the ordinary grain drill; and (3) drilling with a specially devised drill known as the open-furrow drill.

Oats often are sown broadcast, but this method is not generally recommended. When sown broadcast and harrowed in, much of the seed is left near or on the surface, no matter how well prepared the ground may be. As a result too many plants are poorly rooted and are killed by heaving or by cold winter temperatures.

If the seed must of necessity be broadcast, a better method is to sow the seed on clean ground that has been disked, covering it about 3 inches deep with the turn plow. This should leave the surface of the soil rather rough, which will afford some winter protection for the plants. More seed should be used in broadcasting than when the oats are drilled.

The use of the grain drill in seeding oats is strongly recommended for the fall-sown oat area. Drilling produces a more uniform stand and more even germination and growth than broadcast seeding. Drilling requires less seed, and as the seed is uniformly placed in the soil at a favorable depth, the plants are less subject to winter-killing than when the seed is broadcast. Drilling at least 3 inches deep on well-prepared land, leaving the drill furrows as open as possible, is advised.

Drag chains should not be used on the drill, nor should the land be harrowed after drilling. The young plants growing in the bottoms of the rather shallow furrows made by the drill are afforded some protection from winterkilling. Figure 5 shows a disk drill in operation sowing winter oats.

Some years ago an open-furrow drill was devised by the Georgia Agricultural Experiment Station especially for use in seeding fall oats. In recent years this type of drill has been materially improved by farm-implement manufacturers, and it now is available on the market at a nominal cost. This drill sows the seed in rows from 16 to 24 inches apart. An ordinary single-row planter also may be used for the purpose. Furrow drills may be obtained with a fertilizer attachment, which distributes the fertilizer in the furrows with the seed. An open-furrow drill is shown in Figure 6.

Although the open-furrow method of sowing winter oats affords considerable protection against injury from winterkilling, it does not give perfect protection in very cold seasons. The seed is sown in drills or furrows several inches deep, so that the roots and crowns of the plants are 2 to 3 inches below the surface. These furrows



FIGURE 5.—Disk drill in operation in the northern part of the fall-sown oat area

are partly filled during the winter by the washing of the soil and alternate freezing and thawing, but the crowns of the plants still remain below the surface and are protected to some extent from cold.

#### TIME OF SEEDING

Fall-sown oats may be sown in many districts of the South at any time from October 1 until late December. Definite information on the best seeding date therefore is of considerable importance.

Fall-sown oats are less hardy than wheat or rye and should be sown earlier to permit them to become well rooted and make considerable growth before cold weather. Oats are seldom attacked by insects in the fall, therefore it is not necessary to delay seeding because of such pests.

In the extreme southern part of the fall-sown area along the Gulf coast seeding may be delayed until late in October or early in November. Just to the north of the Gulf coast region, in northern Louisiana, central Texas, Mississippi, Alabama, and Georgia, and

in the southeastern part of South Carolina, seeding may be done almost any time in October. In the coastal plain sections of the Carolinas and in northern Georgia, Alabama, and Mississippi, southern Arkansas, and north-central Texas the seed should be sown usually between September 25 and October 15. In the coastal plain sections of Virginia, Maryland, and Delaware, in the Piedmont and mountain sections of Virginia and the Carolinas, in the lower altitudes of southern Tennessee, in Kentucky and northern Arkansas, and in Texas and the southeastern corner of Oklahoma, the seed should be in the ground by September 20 if possible.

Results of cooperative date-of-seeding experiments conducted at Athens in northern Georgia indicate that from October 10 to 18 is about the best time for sowing winter oats in the Piedmont section



FIGURE 6.—A modern furrow drill in operation. It will be noted that the oats are sown in a distinct open furrow which affords considerable protection from severe heaving and injury by cold.

of that State. At Tifton in southern Georgia results of similar experiments showed that seeding may be delayed until November 1, but as a rule a little earlier seeding is safer for the coastal plain section of Georgia. The results of these experiments on the whole show that late seeding is one of the factors most responsible for the low yield of fall-sown oats in the South. This is particularly true in the northern portion of the area.

Early seeding of fall-sown oats is very important if the crop is to give a favorable return.

#### RATE OF SEEDING

Results of experiments conducted at several experiment stations in the South show rather conclusively that heavy seeding rates are advisable for fall-sown oats. In Georgia it has been found that the best rate of seeding may vary with the variety sown. From  $1\frac{1}{2}$  to 2

bushels per acre was found to be the best rate for Red Rustproof, and  $2\frac{1}{2}$  bushels for Fulghum. In other localities the seeding rate may be different. When seeding is done with the open-furrow drill it is usually advisable to sow 2 bushels of seed to the acre, and with the ordinary drill  $2\frac{1}{2}$  bushels of seed should be used. Broadcast seeding requires still more, from 3 to  $3\frac{1}{3}$  bushels being necessary.

In the northern portion of the fall-oat area, where the danger from winterkilling is great, and even farther south when the crop is sown late in the fall, it is necessary to increase the rate of seeding. From  $2\frac{1}{2}$  to 3 bushels per acre of Fulghum, and from 2 to  $2\frac{1}{2}$  bushels of varieties like Winter Turf (Virginia Gray), Culberson, and Lee, are about the proper rates of seeding for the colder portions of the fall-oat area.

If the oats are to be used for pasture or hay, somewhat heavier seeding is advisable than when the grain crop is the chief consideration. Where oats are used as a nurse crop for clover or grass, or where grown with vetch or crimson clover, less seed is needed than when oats are grown alone.

#### CULTIVATION

As a rule, winter oats are given little or no cultivation after seeding. Sometimes oats are harrowed after the plants are well through the ground, to destroy weed growth. Where a large number of small weeds appear in the fall after the oats have become established, many of the weeds may be destroyed by a light harrowing before winter. To prevent the harrow from damaging the crop the teeth should be set to slant backward so as to stir a minimum amount of soil, yet destroy the maximum number of small weeds. Such practices are only partially successful and usually are impracticable.

Injury from heaving in the winter and early spring sometimes may be reduced by rolling the land as soon as possible after the heaving takes place. Clay soils, the type most likely to be subject to heaving, should not be rolled while wet.

Some farmers remove large weeds from their oat fields by pulling or digging. Some oats may be tramped down in the operation, but the grain lost probably is more than compensated for by eradicating the weeds and preventing their seeding. Sprays and other chemicals to kill weeds in oats have not proved practicable.

#### HARVESTING THE CROP

##### CUTTING

Fall-sown oats usually are cut with the grain binder (figs. 7 and 8), but when the area is too small to justify the use of this machine, the mower, or even a cradle or a scythe, may be used. The percentage of oats in the fall-sown area cut with the harvester-thresher combine is rather small as yet, although this machine apparently is gaining in favor each year.

If the oats are cut with the binder they should be allowed to stand until the upper kernels in the panicle have passed the hard-dough stage. If the oats are cut too green they are likely to mold in the shock, and if the harvest is delayed too long shattering is likely to

result. The red oats widely grown in the South may shatter somewhat if allowed to become thoroughly mature before harvest. If the oats are cut with the mower or by hand they should be cut a trifle greener than when the binder is used, in order to prevent undue shattering. Cradled oats may be allowed to cure in the swath a few days before binding.

#### SHOCKING

If oats are cut a trifle green in order to utilize the straw for roughage or to avoid damage from storms, they may mold if shocked at once. If allowed to dry somewhat in the windrow the likelihood of damage is considerably lessened. When oats are cut in the hard-dough stage they usually can be shocked as fast as cut, without danger.



FIGURE 7.—Harvesting fall-sown Red Rustproof (Appler) oats with binder and tractor in Georgia

In the southern part of the United States special care should be given to the shocking of oats, as injury from rains is more likely to occur there than in many other sections.

Two types of shocks are commonly used for oats, the long type and the round one. The round shock is used almost exclusively in the South. The properly capped round shock probably will resist rain better than the long shock.

Ordinarily from 10 to 12 bundles are used in setting up a round shock. (Fig. 9.) One or two extra bundles are used for capping. Smaller shocks may be built, but usually they do not stand so well and more grain is exposed to the weather. The shocks should be carefully built. Proper shocking will insure grain of higher quality under nearly all conditions.

## STORING AND STACKING

In many parts of the southern oat area, oats are stored in barns in the bundle, as the greater portion of the crop is fed to work stock without threshing. All bundle oats should be thoroughly dry and well cured in the shock before storing in barns for long periods of time. Such grain should be protected as much as possible from rats and other vermin, as well as from the Angoumois grain moth. Thorough cleaning of barns or other storage space to get rid of all material favorable to the breeding of rats, moths, etc., before storing the grain is a good precaution.

If stacking is necessary it is essential to build stacks that will protect the oats. The stack should be placed in a dry location. It often is best to make a foundation by laying down fence posts or poles or other light timbers to keep the oats off the ground. The size of the foundation will vary with the size of the stack. In stacking,

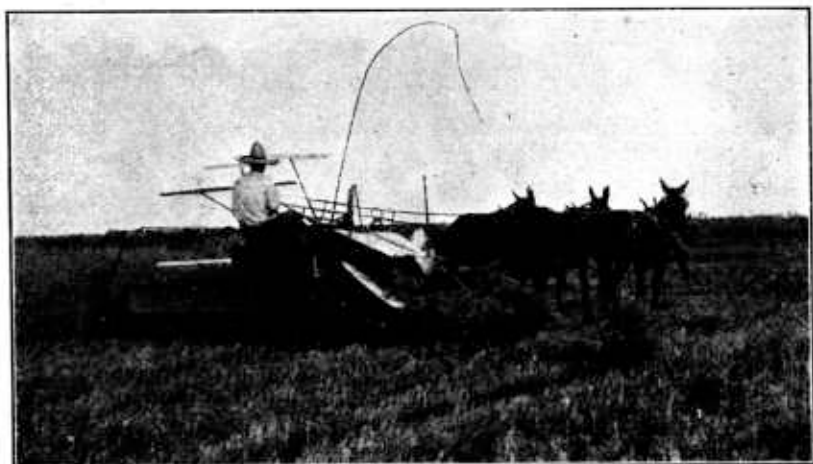


FIGURE 8.—Harvesting fall-sown Nortex oats with binder in Texas

the center of the stack always should be kept well tramped, well filled, and free from holes. The outer row should not be tramped, so that when the stack settles the straw of the exposed bundles or butts will slope distinctly downward and shed water perfectly.

Properly completing and securing the top of the stack also is important. The top of the stack should taper gradually and symmetrically to a point. The few last bundles should be put on like the cap bundles of a shock. They may be held in place by driving a sharpened stake 6 to 8 feet long down into the center of the stack. Weights made of two light timbers tied together with wire or rope also may be hung over the top of the stack to keep the top bundles in place. Where stacking is necessary, attention to these and other details will insure more complete protection of the grain.

## THRESHING

Oats may be threshed from the shock or from the stack. Threshing from the shock should never be attempted when the oats are

damp. Oats may be threshed either before or after sweating in the shock. When threshed before sweating the grain will go through the sweat in the bin. If oats are dry when threshed from the shock, even before going through the sweat, there is little probability that they will be bin damaged. Usually it is better to allow oats to become well cured in the shock, stack, or mow before threshing. When stacking is practiced sufficient time usually elapses to allow the oats to become thoroughly stack cured.

The essentials of good threshing are that all grain be removed from the straw, that the grain be not cut unduly by the cylinder teeth, and that the separator do a reasonably good job of cleaning. By strict attention to detail it is possible to keep oat varieties in a pure



FIGURE 9.—Shocking fall-sown Red Rustproof oats in a field in Madison County, Miss. Well-built shocks, properly capped, help to protect the grain from injury by weather

condition for a number of years, and also to prevent the spread of noxious weeds from farm to farm. Care should be taken to see that the separator is thoroughly cleaned prior to being brought to the farm, if varieties are to be kept in a reasonably pure condition.

As oat straw is widely used for roughage, care should be taken to protect it from the weather. If barn or mow space is not available for storage, the straw should be stacked. Oat straw is a valuable roughage for livestock, being superior to wheat or barley straw. The straw not needed for roughage should be used for bedding farm animals and the making of manure.

#### WINTER OAT VARIETIES

Varieties of two rather definite groups of oats are grown in the South from fall seeding. The first group includes the less hardy

Red Rustproof and Fulghum varieties and their variously named strains. The second group includes the hardier and more cold-resistant Winter Turf, Culberson, Tech, and Lee varieties.

The growing of the red-oat varieties from fall seeding is limited to the southern portion of the winter-oat belt (the Cotton Belt proper). The more hardy varieties, such as Winter Turf and Culberson, are grown in the northern portion of the winter-oat belt, extending from Virginia westward through Kentucky, Tennessee, and Arkansas.

#### RED RUSTPROOF

Red Rustproof and its strains are the most widely grown of the fall-sown oat varieties. The straw is short to midtall, straight and stiff, and of a reddish color. The panicles are rather small with ascending branches. The kernels are large, broad, and plump, and reddish brown. Both kernels of the spikelet often are awned, the awn usually being straight and weak. In most of the fall-oat area Red Rustproof ripens as a midseason variety when compared with Fulghum. Usually it is relatively free from smut, and most strains are more or less resistant to crown rust, although the name Red Rustproof is misleading as to its rust resistance.

There are several named strains of Red Rustproof. Some of the best known are Texas Red Rustproof (also called Red Texas, or Texas Red), Ferguson No. 71, Bancroft, Appler, Cook, Coker Appler, Hasting (Hundred Bushel), Ferguson No. 922, Patterson, and Nortex. All of these are similar in appearance, and nearly all were originated at one time or another as selections. Some of the best known of the older strains are Appler, Bancroft, Cook, Hasting, and Ferguson No. 71. The more recent improved strains are Nortex and Ferguson No. 922.

Nortex was originated by the Texas Agricultural Experiment Station at substation No. 6 (Denton). It is typical of the Red Rustproof variety. Its superior characters are high yield, stiff straw, and maturity from one to three days earlier than ordinary Red Rustproof. Nortex is recommended especially for fall seeding in north-central Texas. It has been registered (Reg. No. 67) by the American Society of Agronomy and the Bureau of Plant Industry as an improved variety of merit.

Ferguson No. 922 is a recent production of the Ferguson Seed Farms, Sherman, Tex. It may replace to some extent the original Ferguson No. 71, which has been a standard strain of Red Rustproof in northern Texas. Ferguson No. 922 is a fairly high-yielding strain of Red Rustproof, but it is not superior to the old No. 71 or to Nortex in uniformity and productiveness.

#### FULGHUM

Fulghum doubtless is the most important distinct variety of oats having its origin in the United States. It was originated a few decades ago in southeastern Georgia as a plant selection in a field of Red Rustproof oats. The initial selection was made by a man named Fulghum. Probably it resulted from a natural hybrid. It first came into prominence in that section as a fall-sown oat, and its possibilities as a spring-sown oat were discovered later. Its exten-

sion in the South as a fall-sown oat has been rapid, until in recent years it has rivaled the Red Rustproof in importance.

Fulghum differs from Red Rustproof when grown under conditions of fall sowing in that it is earlier in maturity and a little taller and has more slender kernels which are less often awned and bear fewer basal hairs. Fulghum is more susceptible to crown rust and to smut than Red Rustproof. Among the strains of Fulghum mainly used for spring seeding, but grown to some extent from fall seeding, are Kanota and Frazier.

At the Arlington Experiment Farm of the United States Department of Agriculture at Rosslyn, Va., several promising Fulghum strains have been developed that are decidedly more cold resistant than the original Fulghum. The commercial value of these is not fully determined.

#### WINTER TURF

The Winter Turf variety, also called Virginia Gray, Winter Grazing, Gray Winter, and several similar names, often is considered better adapted to pasture and hay than to grain production. The plants are more spreading in early growth than those of the Red Rustproof variety and are much more winter-hardy. The leaves are narrow and dark green. The straw is rather tall and slender, and the panicles are large, open, and spreading. The kernels are midsized, usually gray in color, with distinct dark-gray lines running from the kernel base to the tip. Winter Turf usually is both awned and awnless, but the awns break off readily in threshing. The variety is not resistant to rust or smut and is subject to lodging. Winter Turf is adapted to the northern portion of the fall-sown oat area. Farther south it matures too late and often is injured by hot weather and drought. It is very uniform in all plant characters and is easy to identify and maintain in pure stocks. The several names applied to it sometimes may denote distinct physiological strains, which, however, usually conform to the Winter Turf type in all observable characters.

#### CULBERSON

The Culberson variety resembles Winter Turf in some characters, differing mainly in having dull, white or grayish kernels which usually bear awns. It is somewhat earlier than Winter Turf but slightly less winter-hardy. Culberson is little grown at the present time. There are several strains of Culberson, the Dwarf Culberson and Hairy Culberson being best known. These are early and short-strawed selections of the original variety, the latter differing from Dwarf Culberson in that the young plant is covered with short hairs. Dwarf Culberson is grown to a slight extent in Tennessee.

#### TECH

Tech (also known as V. P. I. No. 1) is a selection originated by the Virginia Agricultural Experiment Station at Blacksburg. It is not easily confused with any of the other fall-sown varieties because of its black kernels. Owing to some prejudice against black color in oats, it is not likely that Tech will become of widespread commer-

cial importance. However, in Virginia it has shown considerable winter resistance and also high-yielding ability. It matures from a week to 10 days earlier than Winter Turf, which is a decided advantage under some conditions. Tech has been registered (Reg. No. 63) as an improved variety of merit by the American Society of Agronomy and by the Bureau of Plant Industry. Strains similar to Tech, known as Hatchett and Black Winter, have attained little commercial importance.

#### NEW VARIETIES

Several new and promising varieties of winter oats have been developed in the last few years. The merits of these have not been fully demonstrated on farms. Among these are Lee and Custis, originated by crossing Winter Turf with Aurora, an early oat lacking cold resistance, but with short, plump, thin-hulled kernels. In these two varieties the desirable characters of the parent varieties have been combined to a high degree. They are nearly as cold resistant as Winter Turf and have the excellent kernel characters of Aurora. The range of Lee and Custis apparently is limited to the northern part of the fall-sown oat area in southern Maryland, Virginia, western North Carolina, Tennessee, and Arkansas. They are not adapted to the Cotton Belt. Lee has been registered (Reg. No. 64) by the American Society of Agronomy and by the Bureau of Plant Industry as an improved variety of merit.

#### FALL-SOWN OATS FOR HAY AND GRAZING

Fall-sown oats make an excellent hay and winter-grazing crop for stock of all kinds. The crop may supply considerable pasturage and later may be used for hay or grain. Oat hay is easily cured and very palatable to farm animals. The yield and feeding value may be increased by growing the oats in mixtures with some winter legume, such as hairy vetch. This combination is the most popular hay mixture in much of the fall-sown oat area. The crop may be grazed during the winter and still produce valuable hay when cut in late spring or early summer. In the southern part of the fall-sown oat area, lespedeza, a spring or summer legume, may be sown in the oats without covering the seed in February, thus providing summer grazing without additional cost.

Pasturing fall-sown oats may reduce the yield of grain. However, judicious pasturing of the growing oats sometimes may be an advantage from the standpoint of grain production. When fall-sown oats are grown on fertile soils and not pastured, considerable lodging may occur with consequent loss of grain. Under these conditions pasturing is beneficial. The winter pasture supplied by fall-sown oats in some sections of the South, particularly in Texas, is an incidental crop of considerable importance. When a winter-grain crop is sown primarily for pasture it is usually better to use wheat or rye, as these crops can be pastured more closely than oats and still produce a fair crop of grain. Oats should be closely pastured only when the land is to be plowed and used for some other crop in the spring.

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